DEPARTMENT OF COMMUNITY HEALTH
RADIATION SAFETY SECTION
IONIZING RADIATION RULES

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R325.5481. Purpose and scope.

Rule 481. (1) This part establishes radiation safety requirements for miscellaneous radiation sources and for persons utilizing such sources not exempted under rules 31 to 33 and not specifically covered elsewhere by these rules.

(2) This part applies to all persons who use sources of radiation not specifically covered by the other parts.

(3) In addition to the requirements of this part all persons and activities covered by this part are subject to the applicable provisions of parts 1, 2, 4 and 5.

ANALYTICAL X-RAY SOURCES

R325.5482. X-ray equipment.

Rule 482. (1) Tube housing leakage from analytical x-ray sources shall not exceed 0.5 milliroentgen per hour at a 5 centimeter distance from the surface of the tube housing with the beam ports blocked and the tube operating at its leakage technique factors. Also, radiation originating from the high voltage power supplies shall not exceed this limit.

(2) For instruments in which the primary x-ray beam is completely enclosed, the radiation shall be less than 2 mR per hour at a distance of 25 centimeters from the cabinet surface.

(3) For enclosed equipment, interlocks shall be provided on all access panels which will terminate exposure and prevent operation while the panel is removed.

(4) For open beam analytical x-ray equipment:

- **(a)** X-ray diffraction cameras shall have the appropriate ports arranged so that the camera collimating system shall be in place before the x-ray tube can be energized or the shutter can be opened.
- **(b)** An adapter between the x-ray tube and the collimator of the diffractometer camera or other accessory shall provide the same protection as required by subrule (1).
- **(c)** Safety interlocks shall never be used as routine cut-off switches during normal operation. They shall be operated as safety devices only, and tested periodically. When the interlock system does turn off the x-ray beam, it shall be necessary to reset the "on" switch at the control panel to resume operation.
- **(d)** Tube head ports which are not in use shall be secured in a closed position and interlocked to the x-ray generator or warning system.
- **(e)** The shutter indicator shall be conspicuously displayed to disclose the "open" or "closed" position of the shutter.
- **(f)** The instrument shall display a conspicuous warning label such as "CAUTION RADIATION - THIS EQUIPMENT PRODUCES X-RADIATION WHEN ENERGIZED."
- **(g)** A red warning light shall indicate "X-RAY ON" when the equipment is producing x-rays. Other signal lights or alarms shall operate only to indicate a malfunction which may produce a radiation, electrical or other hazard.

R325.5484. Administrative procedures.

Rule 484. A radiation protection supervisor shall be appointed to be responsible for radiation safety. This individual shall not normally operate the x-ray equipment. He or his designated representative shall:

- **(a)** Insure that operational and maintenance procedures are followed.
- **(b)** Provide instruction in safety practices for all individuals working with the x-ray equipment, and those working in the immediate area or periodically review the safety instruction provided for such individuals.
- **(c)** Maintain a personnel monitoring system.
- **(d)** Review, approve and supervise modifications or replacement of parts for the x-ray apparatus.
- **(e)** Conduct such surveys and tests as necessary to certify compliance with these rules, including any specific registration conditions and maintain records thereof for examination by the department.

R325.5485. Operators.

Rule 485. (1) An individual shall not be permitted to act as the operator of analytical x-ray equipment until he has received training in radiation safety and has been approved by the radiation protection supervisor or his designated representative. The operator shall also demonstrate competence in the use of the machine and radiation survey instruments.

(2) The operator shall be responsible for complying with all procedures associated with the x-ray equipment.

R325.5486. Operating procedures.

Rule 486. A set of operating procedures shall be posted on or adjacent to the machine, written in understandable, concise language.

R325.5487. Personnel monitoring.

Rule 487. An operator of analytical x-ray equipment shall be provided with finger or wrist radiation monitoring devices. Any person coming in contact with equipment capable of exposing a major portion of the body shall be required to wear whole-body monitoring equipment at all times. Personnel

coming in contact with this equipment shall be warned of the nature and type of physiological effects that may be expected when overexposed to radiation.

COLD-CATHODE GAS DISCHARGE TUBES

R325.5491. Rules applicable.

Rule 491. Cold-cathode gas discharge tubes designed to demonstrate the effects of a flow of electrons or the production of x-radiation are subject to the requirements of rules 492 to 495.

R325.5492. Exposure rate limit.

Rule 492. (1) Radiation exposure rates produced by cold-cathode gas discharge tubes shall not exceed 10 mR/hr at a distance of 30 centimeters from any point on the external surface of the tube, as measured in accordance with rule 493.

(2) The divergence of the exit beam from tubes designed primarily to demonstrate the effects of x-radiation, with the beam blocking device in the open position, shall not exceed π (Pi) steradians.

R325.5493. Measurements.

Rule 493. (1) Compliance with the exposure rate limit specified in rule 492 (1) shall be determined by measurements averaged over an area of 100 square centimeters with no linear dimension exceeding 20 centimeters.

(2) Measurements of exposure rates from tubes in enclosures from which the tubes cannot be removed without destroying the function of the tube may be made at a distance of 30 centimeters from any point on the external surface of the enclosure under the following conditions:

- **(a)** In the case of enclosures containing tubes designed primarily to demonstrate the production of x-radiation, measurements shall be made with any beam blocking device in the beam blocking position.
- **(b)** In the case of enclosures containing tubes designed primarily to demonstrate the effects of a flow of electrons, measurements shall be made with all movable or removable parts of such enclosure in the position which would maximize external exposure levels.

R325.5494. Test conditions.

Rule 494. (1) Measurements shall be made under the conditions of use specified in instructions provided by the manufacturer.

(2) Measurements shall be made with the tube operated under forward and reverse polarity.

R325.5495. Instructions, labels and warnings.

Rule 495. (1) Manufacturers shall provide, or cause to be provided, with each tube to which rules 492 to 495 are applicable, appropriate safety instructions, and instructions for the use of the tube, including the specification of a power source for use with the tube.

(2) Each enclosure or tube shall have inscribed on or permanently affixed to it, tags or labels, which identify the intended polarity of the terminals and; (a) in the case of tubes designed primarily to demonstrate the heat effect, fluorescence effect or magnetic effect, a warning that application of power in excess of that specified may result in the production of x-rays in excess of allowable limits; and (b) in the case of tubes designed primarily to demonstrate the production of x-radiation, a warning that this device produces x-rays when energized.

(3) The tag or label required by subrule (2) shall be located on the tube or enclosure so as to be readily visible and legible when the product is fully assembled for use.

X-RAY FILM IDENTIFICATION MARKERS

R325.5501. General provisions.

Rule 501. (1) All devices utilizing sources of radiation for the purpose of marking x-ray film for identification purposes shall be subject to the requirements of this rule.

(2) The radiation source and all objects exposed thereto shall be within a permanent enclosure.

(3) Reliable interlocks shall be provided to prevent access to the enclosure during irradiation.

(4) The radiation exposure at any accessible position 5 centimeters from the outside surface of the enclosure shall not exceed 0.5 mR in any 1 hour.

(5) A person in the environs of the installation shall not be exposed more than the maximum permissible dose equivalent specified in rule 205.

(6) Before a new installation is placed in operation a radiation protection survey shall be conducted in accordance with rule 221. A written report of this initial survey shall be submitted to the department and approved before a certificate of registration for the devices is issued.

(7) A record of the survey required by subrule (6) shall be maintained at the installation for examination by the department.

ELECTRON MICROSCOPES

R325.5505. Equipment.

Rule 505. (1) During any phase of operation of an electron microscope at the maximum rated continuous tube current for the maximum rated peak tube potential the radiation exposure rate as measured in air at a distance of 5 centimeters from any accessible point on the external surface of the microscope shall not exceed 0.5 mR per hour.

(2) Interlocks shall be provided on all potential radiation hazard access panels which will terminate exposure and prevent operation while the panel is removed.

(3) The instrument shall display a conspicuous warning label such as "CAUTION RADIATION – THIS EQUIPMENT PRODUCES X-RADIATION WHEN ENERGIZED."

R325.5506 Administrative procedures.

Rule 506. A radiation protection supervisor shall be appointed to be responsible for radiation safety. This individual shall not normally operate the electron microscope. He or his designated representative shall:

- **(a)** Insure that operational and maintenance procedures are followed.
- **(b)** Provide instruction in safety practices for all persons working with the electron microscope, and those working in the immediate area.
- **(c)** Maintain a personnel monitoring system if provided.
- **(d)** Review, approve, and supervise modifications or replacement of parts for the electron microscope.
- **(e)** Conduct such surveys and tests as necessary to certify compliance with these rules, including any specific registration conditions and maintain records thereof for examination by the department.

R325.5507. Operators.

Rule 507. (1) An individual shall not be permitted to act as operator of an electron microscope unless he has demonstrated to the satisfaction of the radiation protection supervisor or his designated representative:

- **(a)** Competence in the safe use of the instrument.
- **(b)** Awareness of the potential radiation hazard which could result from improper adjustment or misuse of the instrument.

(2) The operator shall be responsible for complying with all procedures associated with the instrument.

R325.5508. Operating procedures.

Rule 508. A set of operating procedures shall be posted on or adjacent to the electron microscope, written in understandable, concise language. Appropriate precautions for the safe handling of uranyl salts or other radioactive biological stains shall be included if such substances are used.

[*Note: The requirements of this rule that pertain to radiation machine registration, licensing, or compliance are under the purview of the Michigan Department of Community Health.*]

OTHER MISCELLANEOUS SOURCES

R325.5511. License or registration conditions.

Rule 511. Types of radiation sources and uses not specifically covered by these rules shall be subject to specific requirements designated by the department in the form of license or registration conditions for the protection of public health, safety and property until such time that these rules are amended to specifically cover such sources and uses.